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Original Article

High and Mighty: Height Increases Authority in Professional Refereeing

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Abstract: Throughout the animal kingdom, larger males are more likely to attain social dominance. Several lines of evidence suggest that this relationship extends to humans, as height is positively related to dominance, status and authority. We hypothesized that height is also a determinant of authority in professional refereeing. According to the International Football Association Board, FIFA, football (“soccer”) referees have full authority to enforce the laws of the game and should use their body language to show authority and to help control the match. We show that height is indeed positively related to authority status: referees were taller than their assistants (who merely have an advisory role) in both a national (French League) and an international (World Cup 2010) tournament. Furthermore, using data from the German League, we found that height was positively associated with authoritative behavior. Taller referees were better able to maintain control of the game by giving fewer fouls, thereby increasing the “flow of the game”. Referee height was also positively associated with perceived referee competence, as taller referees were assigned to matches in which the visiting team had a higher ranking. Thus, height appears to be positively related to authority in professional refereeing.

Keywords: stature, dominance, soccer, refereeing, authority

Introduction

Throughout the animal kingdom, larger males are more likely to attain social dominance (Andersson, 1994; Archer, 1988; Ellis, 1994; Isaac, 2005), which is the ability

to acquire resources in the presence of others through either agonistic or affiliative strategies (Pellegrini and Bartini, 2001). Several lines of evidence suggest that this positive relationship between body size and social dominance extends to humans. First of all, taller men are more likely to win physical fights as they are physically stronger (Sell et al., 2009), have an enhanced capacity to deliver potentially damaging strikes (Carrier, 2011), and react more aggressively in sports (Webster and Xu, 2011). Additionally, taller men are less sensitive to cues of dominance in other men (Watkins et al., 2010) and respond with less jealousy towards socially and physically dominant rivals than do shorter men (Buunk, Park, Zurriaga, Klavina and Massar, 2008). These findings suggest that it is more important for shorter men, as compared to taller men, to accurately gauge a rival's dominance given the higher costs associated with engaging in a fight if a competitor is miscategorized. Similarly, taller men could be (or perceive themselves to be) better able to deter dominant rivals, which would reduce the need for jealousy.

Perceptions of height and dominance are also closely related. Taller men are perceived as more dominant than shorter men (Montepare, 1995), and, vice versa, more dominant men are estimated as taller than less dominant men (Dannenmaier and Thumin 1964; Marsh, Yu, Schechter and Blair, 2009). Similarly, the losing candidates in political elections are judged as shorter, whereas the winning candidates are judged as taller than they were perceived to be before the election (Higham and Carment, 1992). People also judge politicians whom they support as taller than politicians whom they oppose (Sorokowski, 2010). Perceptions of height also affect behavior. Huang and colleagues (2002), for example, manipulated the camera angle in a negotiation task and found that men who were perceived as taller were more influential in the task than men who were perceived as shorter. The positive relationship between size and perceived dominance is even apparent in very young children: Thomsen, Frankenhuys and Carey (2011) showed that children as young as ten months old recognize that size plays a role in dominance contests, and are "surprised" by (i.e., pay more attention to) a situation in which a smaller individual dominates a larger individual.

Perhaps because of their increased physical (Sell et al., 2009), behavioral (Watkins et al., 2010) and/or perceived dominance (Marsh et al., 2009), height is positively related to access to actual resources in humans. This is supported by the findings that taller individuals (particularly men) are more likely to have higher starting salaries (Loh, 1993), higher overall income (Judge and Cable, 2004), and are more likely to be promoted (Melamed and Bozionelos, 1992) than shorter men. Not surprisingly therefore, height is positively related to authority status. For example, when one's dominance is exercised legitimately, taller individuals are more likely than shorter individuals to occupy a leadership or managerial position (Gawley, Perks and Curtis, 2009; Stogdill, 1948). These findings extend to politics, because since 1896, U.S. citizens have always elected a President whose height was considerably above average (Judge and Cable, 2004). Moreover, Presidents whose presidency was considered "great" were taller than those whose presidency was considered a "failure" (Sommers, 2002). Thus, taller men are more likely to obtain a position of authority, and when they do, are considered more successful.

Giving the above findings, we hypothesized that male height may also be related to authority in a different setting: professional football ("soccer") refereeing. According to the

International Football Association Board, FIFA, football referees have full authority to enforce the laws of the game and can use their body language to show authority and help control the match (*Laws of the Game*; FIFA, 2012). Similarly, the website of the British Football Referees' Association (2010) states that a referee always has to “*keep control [of the game], by bending his authority to encourage the flow of the game*”. These recommendations are not surprising, given the fact that referees have to deal with verbal and physical aggression not only from players, but also from coaches, and spectators (Folkesson, Nyberg, Archer and Norlande, 2002). With almost every blow of the whistle, half of the players, coaches and crowd are likely to disagree with the referee's decision.

We examined whether height was related to authority and authoritative behavior in professional refereeing. First, we examined whether or not referees were taller than their assistants (who merely have an advisory role) in the French professional League (Study 1) as well as during the 2010 World Cup that took place in South Africa (Study 2). Furthermore, we investigated whether there was an association between referee height and authoritative behavior on the football pitch. A recent study by Van Quaquebeke and Giessner (2010) investigated the association between height and dominance in football players. In this study, taller players were perceived as committing more fouls than shorter players. We hypothesize that, apart from player height, referee height is also related to authority and dominance on the pitch (Study 3). We predicted that relatively taller referees would be better able to maintain control of the game (i.e. players would be more wary of committing fouls or retaliating towards other players) and would increase the “flow of the game” by having to give fewer fouls (Study 3). Furthermore, we predicted that the allocation of referees to matches by the football league is contingent on referee height, with taller referees being appointed to more important matches.

Study 1: Ligue 1 (French Professional league) referees

Material and Methods

The aim of our first study was to investigate the relationship between height and status success in professional refereeing. We collected data on assistant referees ($n = 64$) and referees ($n = 38$) from six seasons of Ligue 1 (2004/2005 to 2009/2010), the top French football league from the website <http://www.worldfootball.net/>. One individual acted as both referee and assistant referee during this period; he was classified as a referee in our analyses. We chose the French league because all referee heights and the majority of assistant referee heights were available (only five out of 69 heights of assistant referees were missing; for consistency with Study 3, we preferred to have data on the German league (Bundesliga). Unfortunately, for this league, more than one third of all assistant referees' heights were missing). Independent sample t -tests were performed to test whether head referees were significantly taller than their assistants.

Results

Referees were on average 4.09 cm taller than assistant referees (Figure 1a; t -test; M

= 179.71; $SD = 5.49$ cm versus $M = 175.62$; $SD = 7.32$ cm; $t(100) = 2.98$; $p = .004$; $d = 0.62$). No difference in age was found between referees ($M = 41.00$ years; $SD = 5.39$) and assistant referees ($M = 41.41$ years, $SD = 5.83$; t -test; $t(102) = 0.35$; $p = .724$, $d = 0.07$). The effect of height can thus not be attributed to the association between age and height.

Study 2: World Cup referees

Material and Methods

To replicate our finding for the French league we collected data from the FIFA-website (www.fifa.com) on all referees and assistant referees who officiated in the 64 matches of the 2010 World Cup in South Africa. In total, 29 trios consisting of one referee ($n = 29$) and two assistant referees ($n = 58$) were invited for the World Cup. Referees were either assigned as an “active” referee or as “stand-in” referee (fourth official) during a match. Similarly, assistant referees were either assigned as an “active” assistant referee or as “stand-in” assistant referee (fifth official). The fourth official is the primary replacement of the referee when he is unable to continue officiating, whereas the fifth official is the primary replacement of the assistant referee.

Only four individuals were assigned exclusively as referee during the tournament. Thirteen officials acted more often as referee than as fourth official, seven acted more often as fourth official than referee, and five acted only as fourth official. With respect to the assistant referees and fifth officials: twenty-two officials acted exclusively as assistant referee, seventeen acted more as assistant referee than as fifth official, nine acted more often as fifth official than assistant referee, and ten acted only as fifth officials. Referees or fourth officials never officiated as an assistant referee or fifth official and no assistant referee or fifth official ever officiated as referee or fourth official. We classified officials on the basis of their most common overall assignment throughout the tournament (e.g., an individual officiating as an assistant referee more often than as a fifth official was classified as an assistant referee). This led to the following classification of officials: 17 referees, 12 fourth officials, 39 assistant referees, and 19 fifth officials.

We tested whether there was a difference in height between referees and assistant referees and between “active” and “stand-in” (i.e. the 4th and 5th official) referees. Given that height varies between countries, and that referees and assistant referees were invited in trios, often with individuals from the same or neighboring countries, we included the trio as a random effect. Inclusion of such a random effect rules out that the effect found for height is an artifact of between-country variation in height.

Results

In 26 out of the 29 invited trios, the referee was taller than at least one assistant referee, and in 17 trios the referee was taller than both assistants. The invited 29 referees were on average 4.31 cm taller than the 58 invited assistant referees (t -test; $t(85) = 2.94$; $p = .004$, $d = 0.68$). When taking into account the overall assignment of the officials, the between-country variation in height and the age of the officials, referees were estimated

4.17 cm taller than assistant referees (Linear mixed model parameter estimate ($\pm SE$): -4.17 ± 1.14 ; $\chi^2(1, N = 87) = 12.37$; $p = .0004$; see Table 1 and Figure 1b).

There was no significant difference in height between the “active” official and their potential “stand-in” (-0.38 ± 1.72 ; $\chi^2(1, N = 87) = 0.05$; $p = .82$; Table 1). Age was not significantly related to height ($p = .14$; Table 1). The height effect can thus not be attributed to the association between age and height. Parameter estimates for the full model can be found in Table 1.

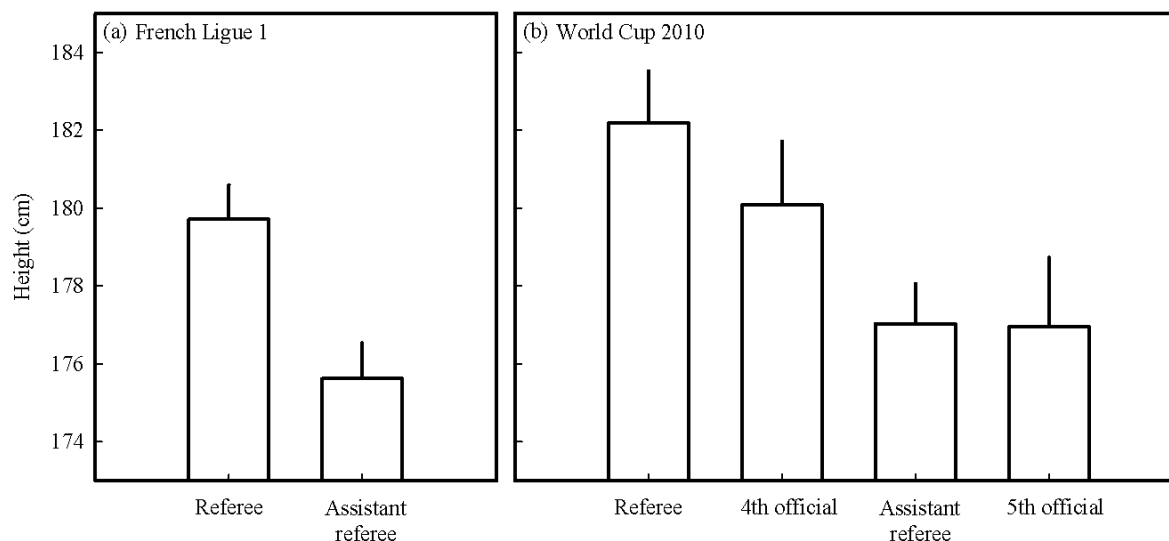
We also investigated whether height was related to the years of international experience a referee had. Taller referees had fewer years of international experience prior to the World Cup (Pearson $r(27) = -.39$; $p = .037$). After controlling for the age of the referee in a partial correlation, the relationship between height and experience became marginally significant ($r(26) = -.37$; $p = .051$). For assistant referees, there was no relationship between experience and height ($r(56) = .15$; $p = .25$).

Table 1. Results from Study 2: Linear mixed model parameter estimates ($\pm SE$) of the effects of age (years), type of referee, “active” versus “stand-in” referee and referee trio (see text) on height.

	Height (cm)
Intercept	$1.81 \cdot 10^2 (\pm 1.38)^{***}$
Referee versus assistant referee ^a	$-4.17 (\pm 1.14)^{***}$
“Active” versus “stand-in” referee ^a	$-3.80 \cdot 10^{-1} (\pm 1.72)$
Age (centered)	$2.75 \cdot 10^{-1} (\pm 1.88 \cdot 10^{-1})$
Random effect referee trio	$1.63 \cdot 10^1 (\pm 4.03)^b$
Residual error variance	$2.42 \cdot 10^1 (\pm 4.91)^b$

^a Referee and “Active” referee are the reference categories; ^b Standard deviation instead of standard error; *** $p < 0.001$

Figure 1. Results from Study 1 and 2: The average height (+SE) in centimeters of (a) the referees and assistant referees in the French league and (b) of the referees, fourth officials, assistant referees and fifth officials during the 2010 World Cup.



Study 3: Bundesliga (German First Division) Referees

Material and Methods

The aim of our third study was to investigate whether authoritative behavior and competence was related to height and experience of a referee. We used football data purchased from Impire AG, a company that specializes in collecting professional sports data (www.ampire.de). Available data comprised 1,530 matches from five seasons (2004/2005 to 2008/2009) of the Bundesliga, the highest professional German football division. For each match the referee's identity ($n = 28$), his height and experience (number of seasons refereeing in the Bundesliga) were available, as well as the average rank of the home and visiting team in the seasons 2004/2005 through to 2008/2009 (1=highest, 18=lowest), the total number of fouls given by the referee, and the number of yellow and red cards that were administered to players. In football, a red card is given for a severe foul, and will result in direct expulsion of the player for the remainder of the match. Two yellow cards, for less severe fouls, will also result in a red card, and hence expulsion. The foul data only include illegal physical contacts towards other players (e.g. unfair tackles), and no other illegal actions that are penalized by the referee (e.g. handball and offside). For all analyses, we included *referee*, the *home team* and the *visiting team* as random factors and *height*, *Bundesliga experience* and *age of referee* as covariates. As referee age was highly correlated with referee experience (Pearson $r(26) = .83$; $p < .0001$), we did not include referee age in the reported models. Including age in the models did not change any of our results, as age never reached statistical significance (all $p > .16$). We tested whether referee height was predictive of measures of authority and control during a game, such as the number of fouls and the number of cards given.

Furthermore, we investigated whether referee height was predictive of the perceived competence of the referee, by examining whether these factors influenced the likelihood of being assigned to matches in which the home or visiting team was high ranking (controlling for respectively the visiting and home team by adding them as a random factor). All analyses were performed in R version 2.11.1 (R Development Core Team, 2008), using the lmer package. In the following we defined “tall” or “experienced” as one standard deviation above the respective mean, and “short” or “inexperienced” as one standard deviation below the respective mean.

Results

Referees were on average 185.18 centimeters tall ($SD = 5.79$) and had on average 6.25 years of Bundesliga experience ($SD = 5.08$) at the start of the seasons 2004/2005 to 2008/2009 (see Table 2 for descriptive statistics).

Table 2. Results from Study 3: Descriptive statistics for the 28 referees and 1,530 matches in five Bundesliga seasons (2004/2005 to 2008/2009).

	Mean ($\pm SD$)	Minimum	Maximum
<i>Referees (n = 28)</i>			
Height (cm)	185.18 (± 5.79)	178	197
Age (years) ^a	35.39 (± 5.27)	22	46
Bundesliga experience (years) ^a	6.25 (± 5.08)	1	17
<i>Matches (n = 1,530)</i>			
Number of fouls	36.86 (± 7.76)	13	70
Number of cards	4.08 (± 2.03)	0	11

^a Age and experience at the first match played during seasons 2004/2005 to 2008/2009.

Referee height was also associated with measures of authoritative behavior during a match. Controlling for the ranks of the playing teams, both referee experience (-0.75 ± 0.11 ; $\chi^2(1, n = 1,530) = 27.45$; $p < .0001$) and height (-0.33 ± 0.15 ; $\chi^2(1, n = 1,530) = 5.26$; $p = .022$; Figure 2a) were negatively associated with the number of fouls in a match (see Table 3 for all parameter estimates), indicating that taller and more experienced referees assigned less fouls and thus interrupted the game less. Experienced referees gave on average 7.63 fewer fouls compared to inexperienced referees. Tall referees gave on average 3.79 fewer fouls than short referees. Experience and height were not significantly associated with the number of cards given in a match (Table 3).

Table 3. Results from Study 3: Generalized linear mixed model parameter estimates ($\pm SE$) of the effects of *height* (centered), *experience* (centered), *home team ranking*, *visiting team ranking* and *referee* on the total number of fouls in a game (linear) and the total number of cards awarded (Poisson).

	Number of fouls	Number of cards
Intercept	$3.66 \cdot 10^1 (\pm 1.01)^{***}$	$1.46 (\pm 4.65 \cdot 10^{-2})^{***}$
Rank Home Team	$1.39 \cdot 10^{-1} (\pm 4.26 \cdot 10^{-2})^{**}$	$5.33 \cdot 10^{-3} (\pm 2.86 \cdot 10^{-3})$
Rank Visiting Team	$-7.42 \cdot 10^{-2} (\pm 4.35 \cdot 10^{-2})$	$-1.29 \cdot 10^{-2} (\pm 2.91 \cdot 10^{-3})^{***}$
Experience (years)	$-7.51 \cdot 10^{-1} (\pm 1.14 \cdot 10^{-1})^{***}$	$-8.44 \cdot 10^{-3} (\pm 4.65 \cdot 10^{-3})$
Height (cm)	$-3.28 \cdot 10^{-1} (\pm 1.46 \cdot 10^{-1})^*$	$3.34 \cdot 10^{-3} (\pm 4.35 \cdot 10^{-3})$
Random effect referee	$1.59 \cdot 10^1 (\pm 3.99)^a$	$8.31 \cdot 10^{-3} (\pm 9.12 \cdot 10^{-2})^a$
Residual error variance	$5.39 \cdot 10^1 (\pm 7.34)^a$	^b

^a Standard deviation instead of standard error; ^b There is no residual error variance in Poisson mixed models because the variance is constrained to the mean; * $p < .05$; ** $p < .01$; *** $p < .001$

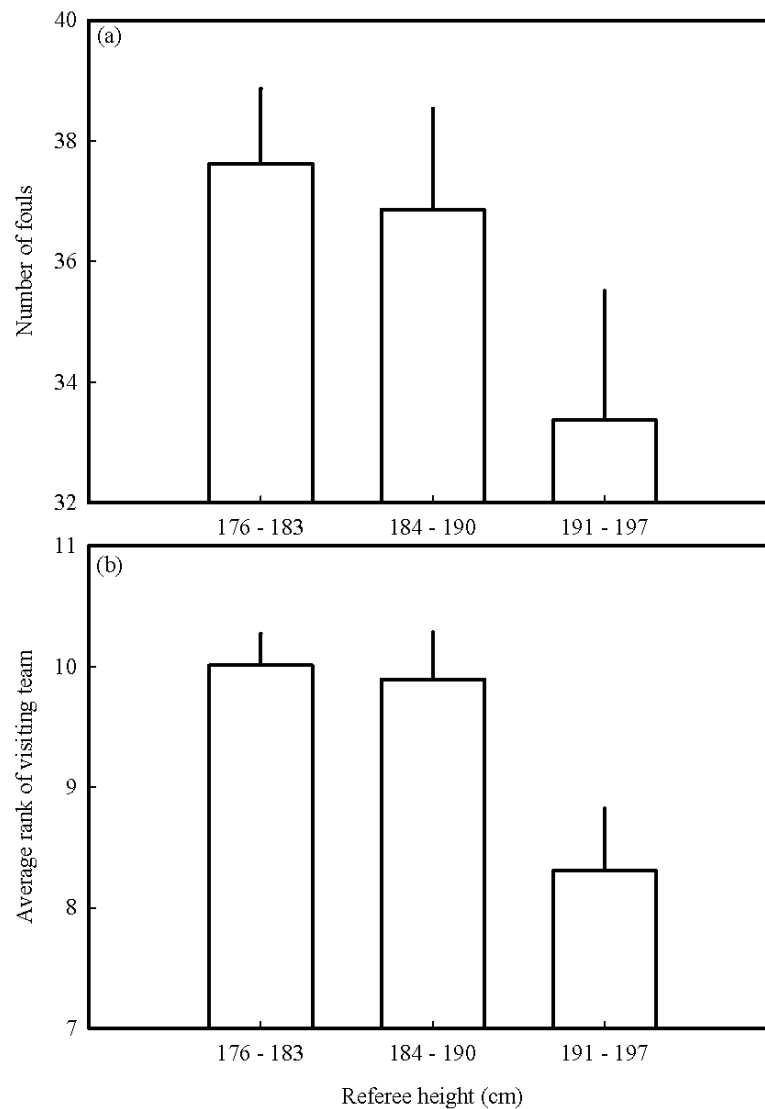
Both *years of Bundesliga experience* (-0.18 ± 0.04 ; $\chi^2(1, n = 1,530) = 17.60$; $p < .0001$) and *height* (-0.08 ± 0.04 ; $\chi^2(1, n = 1,530) = 4.32$; $p = .038$; Fig. 2b) negatively predicted the average rank of the visiting team, but not of the home team (see Table 4 for all parameter estimates). Thus, more experienced and taller referees, as opposed to respectively inexperienced and shorter referees, were assigned to matches where the visiting team had a better performance over these five years (higher ranking means lower average rank). More experienced compared to less experienced and taller compared to shorter referees were assigned to matches in which the visiting team on average was ranked 1.83 and 0.96 higher, respectively (out of 18 teams).

Table 4. Results from Study 3: Linear mixed model parameter estimates ($\pm SE$) of the effects of *experience* (centered), *height* (centered), and *referee* on the rank of the home and visiting team.

	Rank ^a home team	Rank ^a visiting team
Intercept	$9.54 (\pm 1.77 \cdot 10^{-1})^{***}$	$9.71 (\pm 2.13 \cdot 10^{-1})^{***}$
Experience (years)	$-1.69 \cdot 10^{-2} (\pm 3.66 \cdot 10^{-2})$	$-1.81 \cdot 10^{-1} (\pm 4.21 \cdot 10^{-2})^{***}$
Height (cm)	$-1.10 \cdot 10^{-3} (\pm 3.37 \cdot 10^{-2})$	$-8.22 \cdot 10^{-2} (\pm 4.04 \cdot 10^{-2})^*$
Random effect referee	$4.02 \cdot 10^{-1} (\pm 6.34 \cdot 10^{-1})$	$7.59 \cdot 10^{-1} (\pm 8.71 \cdot 10^{-1})$
Residual error variance	$1.98 \cdot 10^1 (\pm 4.45)^b$	$1.90 \cdot 10^1 (\pm 4.36)^b$

^a Average rank of the team in the last 5 seasons of Bundesliga. Lower means better, as 1 is the top rank and 18 the bottom rank; ^b Standard deviation instead of standard error; * $p < .05$; *** $p < .001$

Figure 2. Results from Study 3: Least square means ($\pm SE$) of the effect of referee height in cm (in three equal height range groups) on (a) the number of fouls, and (b) the average rank of the visiting team (lower rank means better team).



Discussion

In this study, we have shown that referees, the leading officials in football, are taller than their assistant referees in both a national (French professional football league) and an international (World Cup 2010) setting. These novel findings are in line with predictions based on previous studies reporting a positive association between height and authority (Gawley et al., 2009; Judge and Cable, 2004).

In addition, we found evidence that the height of referees was associated with their (perceived) competence. First of all, we found that taller referees had relatively less international experience than shorter referees prior to their invitation to the World Cup.

Thus, a tall referee required less experience to be promoted to referee at the highest level. Second, we found that taller and more experienced referees were assigned to matches in which the visiting team had a better performance over the study period in the German League. Hence, as more competent referees are more likely to be assigned to matches with higher ranking teams, both experience and height appear to be indicators of this (perceived) competence. The reason why no effect of height and experience was found on the rank of the home team can be explained by how referees in the Bundesliga are assigned. A referee is registered to a particular region within Germany and is not allowed to officiate in any matches in which teams from that particular region are playing (DFB, 2010). However, for logistical reasons, referees are likely to be assigned to matches in regions neighboring their own. Therefore, the region where the referee is registered constrains the set of home teams that he can be assigned to, and hence the ranks of these home teams he can be assigned to.

We also found evidence that the height of referees was associated with their effectiveness and authority in the field. An important aspect of refereeing, according to the British Football Referees' Association (2010) is to "*keep control [of the game], by bending his authority to encourage the flow of the game*". Taller compared to shorter referees gave fewer fouls, and thus increased the "flow in the game". Apparently, taller referees are better able to control the game by "bending their authority", resulting in players committing fewer fouls (i.e. players would be more wary of committing fouls or less inclined to retaliate towards other players), or they resolved them in another way (e.g. deciding to "play advantage" instead of stopping the game for a foul, because the fouled team still has the advantage in the situation, or by warning players in another way). Similarly, more experienced referees also awarded fewer fouls than less experienced referees. It is worth noting that in the Bundesliga, for both the number of given fouls and the rank of the visiting team, the effect of two extra centimeters in height was comparable to approximately one extra year of experience.

Instead of the increased "flow" or control of the game by taller referees, the negative association between referee height and the number of fouls could also mean that taller referees either notice fewer fouls, or that they are more lenient. Some evidence suggests however, that these alternative explanations are unlikely. Noticing fewer fouls would indicate poor refereeing, as the main job of the referee is to notice and penalize fouls. As mentioned above, referee height was positively associated with measures of the perceived competence of the referee (e.g., being assigned to matches with higher-ranked teams), rendering it unlikely that taller referees are less likely to notice foul play. Additionally, more experienced referees also awarded fewer fouls. As experience is a likely determinant of competence (Dohmen, 2008; Nevill, Balmer and Williams, 2002), the fact that more experienced and taller referees awarded fewer fouls suggests that, awarding fewer fouls is likely to be a sign of competence rather than incompetence. It is also unlikely that the positive relationship between height and number of fouls arises because taller referees are more lenient as no differences were found in the number of cards given by taller referees compared to shorter referees (if anything taller referees were less lenient as they gave fewer fouls than shorter referees, yet handed out similar numbers of cards). Again, these results were mirrored by the effects of experience: no differences were found in the number of cards handed out by experienced referees compared to less experienced

referees. A possible explanation for the finding that both stature and experience are related to the number of fouls but not the number of cards, is that there may simply be too little variation in the number of cards given and hence the possibility to find an effect of height and experience may be reduced. Additionally, perhaps interrupting the game by calling a foul is a more subjective decision than the decision of whether or not a player deserves a card, for which there may be more strict guidelines (FIFA, 2010). In conclusion, the most likely explanation for why taller (or more experienced) referees give less fouls, is that due to the authority a tall (or experienced) referee induces, he can increase the “flow” of the game.

The present study does not address the process underlying the association between height and authority. It could arise as a consequence of the association between height and actual ability of the referees. Previous studies have proposed several hypotheses explaining this association, including the positive relationship between height and cognitive ability (explained by common factors such as genes or nutrition; Silventoinen, Posthuma, van Beijsterveldt, Bartels and Boomsma, 2006), health (Silventoinen, Lahelma and Rahkonen, 1999), participation in social activities in young adulthood (Persico, Postlewaite and Silverman, 2004), and self-esteem (Judge and Cable, 2004). The association between height and authority in referees may also be a consequence of the *perception* of the referees by others. Taller people may be perceived as more competent, authoritative, or dominant (Judge and Cable, 2004; Marsh et al., 2009; Young and French, 1996). Further research is necessary to determine the causal pathways through which height induces (perceived) authority across different settings.

The higher perceived competence of taller men (Judge and Cable, 2004; Young and French, 1996) is likely to lead to discrimination against shorter men. Cinnirella and Winter (2009) showed that in the labor market employer discrimination with respect to height was likely as height was positively related to income in *employees* (i.e. subordinate to their *employers*) and, in contrast, this relationship was not found in self-employed workers (i.e. who have no manager above them and hence are not at risk of discrimination). The finding that taller referees were assigned to higher quality matches could be a consequence of a similar type of discrimination. When actual competence is not related to height and our subconscious biases act to discriminate against short individuals, society should consider policies to guard against this form of discrimination.

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